A quick synopsis of the results of our measurements follows:

- System noise levels varied from ~1–3% depending on signal level and gain in the MCP.
- The limiting resolution of the system, ~17 lp/mm, is very close to the Nyquist frequency of the CCD used (20 lp/mm). The MCP and the lens/CCD combination both contributed roughly equally to the total MTF.
- The dynamic range within a single image was ~700:1. We were able to achieve a usable dynamic range of 22,000:1 by using two separate exposure times. Part of the image was greatly saturated in the longer exposure with no serious bleeding problem.
- The minimum detectable signal was ~0.5 photons/pixel/s at the maximum MCP gain of 70,000 and an exposure time of 80 s. The detector response is highly linear.

Better dynamic range and sensitivity could be obtained with a more modern CCD.

14.05

A Research Amplifying Image Detector (RAID) for the Study of Dynamic Solar Phenomena

G. L. Epstein, M. Swartz and R. J. Thomas (NASA/GSFC)

The fourth flight of the Solar EUV Rocket Telescope and Spectrograph (SERTS) instrument will be dedicated to the study of dynamic phenomena in the upper solar atmosphere with time scales between 10 seconds and 5 minutes. Both periodic and transient phenomena will be explored by measuring intensity variations (due to changes in plasma density or temperature), spatial shifts in specific features (from Doppler shifts or bulk transverse motions), and broadening of features in the spectral dimension (reflecting increased emission line widths). Our observations will be made in the spectral band 344.0–370.4 Å, allowing us to simultaneously and uniformly probe the transition zone and the non-flaring corona over the temperature range 0.4–2.3 × 10^6 °K.

In order to handle the large dynamic range exhibited by the solar corona and transition zone, we have been developing the Research Amplifying Image Detector (RAID). Every 10 seconds the RAID will detect and transmit the two dimensional EUV images of the solar atmosphere formed by the SERTS spectrometer with spatial information perpendicular and spectral information parallel to the dispersion plane. The RAID will have a pixel size of 2 arcsec by 54 mÅ. Its sensitivity will be $\geq 10^8$ photons cm^{-2} sec^{-1}, and its dynamic range > 1000. A laboratory version is now being evaluated at 304 Å and development of a flight unit is underway.

14.06

Optical Design of the SOHO/CDS Experiment

Roger J. Thomas (NASA/GSFC)

The Coronal Diagnostic Spectrometer (CDS) is being developed for the SOHO mission by an international team, including two co-I's from GSFC, led by Bruce Patchett of the Rutherford-Appleton Laboratory. Its primary scientific goals are to investigate the structure of the solar corona, to test potential heating mechanisms, and to determine where and how solar-wind streams are accelerated. To achieve these goals, an instrument was designed that combines moderately good spatial, spectral, and temporal resolutions over a reasonable field of view while simultaneously observing at many wavelengths between 17 and 80 nm. Thus, the CDS will provide measurements of diagnostic EUV line-pair intensities giving temperature and density distributions in the solar atmosphere on spatial and temporal scales appropriate for non-flaring coronal plasmas. It will cover temperatures from roughly 10^5 to 10^7 K, allowing for the first time simultaneous detailed studies of the connections between coronal features and those seen in the transition region.

The optical design of the CDS instrument consists of a grazing-incidence telescope feeding two independent spectrographs. The Wolter Type-2 telescope forms an image of the Sun which can be scanned across the spectrograph entrance aperture in one dimension by a flat mirror, also at grazing-incidence. A portion of the telescope beam then falls on a spherical grating in a Rowland-circle configuration at grazing-incidence which optimizes throughput, especially at the shortest wavelengths. However, since this system is astigmatic, spatial images must be built up point by point using a combination of scan-flat and entrance-aperture motions. To compensate, another portion of the telescope beam illuminates two toroidal gratings that differ only in their ruling density (and a slight out-of-plane tilt) operating near normal-incidence. These form stigmatic images of the entrance slit in two spectral bands, and thus directly complement the astigmatic spectrograph.

TUESDAY